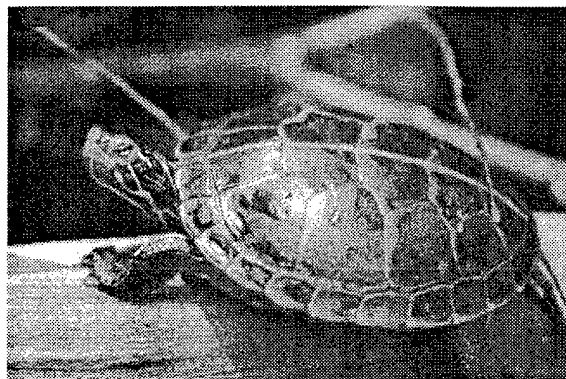


Sensitive Turtle Habitats Potentially Impacted by USACE Reservoir Operations

PURPOSE: This is the first in a series of technical notes concerning sensitive turtle groups. It provides an overview of environmentally sensitive turtle species and habitats as reported by resource managers at U.S. Army Corps of Engineers (USACE) reservoir projects. Current Federal and state legal protection status for U.S. turtle species are summarized and USACE Districts and reservoir projects potentially impacted by turtle conservation issues are identified. For each turtle species identified as potentially impacted by reservoir operations, life history is summarized and habitat requirements are described in subsequent technical notes (Technical Notes EMRRP-SI-02 through EMRRP-SI-08).



Southern Painted Turtle
photo by Dena Dickerson

BACKGROUND: Changing water levels or other operations at USACE reservoirs have potential adverse impacts on the habitats of some environmentally sensitive turtle species. These impacts include changes to vegetation and other habitat parameters that stress biological requirements such as feeding, reproduction, nesting, shelter, and various species-specific behaviors. USACE Districts and regulatory agencies have reported reservoir impacts to specific terrestrial, aquatic, and semi-aquatic turtle species as important issues at various reservoir projects. Habitat-based evaluations of reservoir impacts on these environmentally sensitive species are critically needed to subsequently provide guidelines to prevent or ameliorate impacts and improve watershed components.

METHODS: This study evaluated the extent of issues and geographical locations for environmentally sensitive turtle species affected by reservoir operations Corps-wide (Figure 1). Priority species were identified and categorized into seven groups according to habitat or life-history requirements (Figure 2, Table 1). These data were gathered from responses to an e-mail (or faxed) survey sent to all resource managers at 456 USACE reservoir or other water-control structure projects (i.e., pools, locks, dams). Current Federal and state listings for species protection were gathered and assimilated for turtle species (Figures 3 and 4). Life history and habitat requirement information pertinent to potential reservoir operations (i.e., temporal, spatial, and physical parameters) was assimilated for each priority species. The products from this study proactively address high-priority issues associated with reservoir operation impacts on environmentally sensitive turtle species and their habitats and allow resource managers to quickly address the associated biological, physical, and legal requirements (Figure 5).

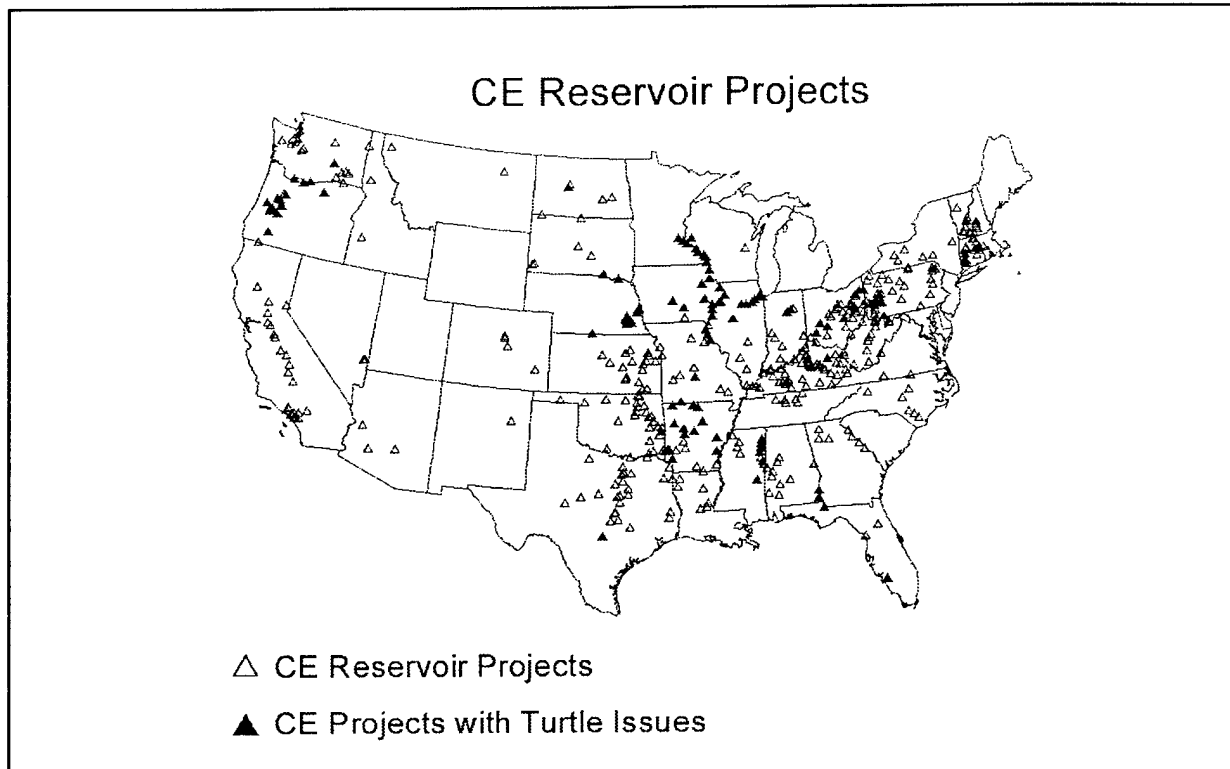


Figure 1. Corps reservoir projects with turtle issues

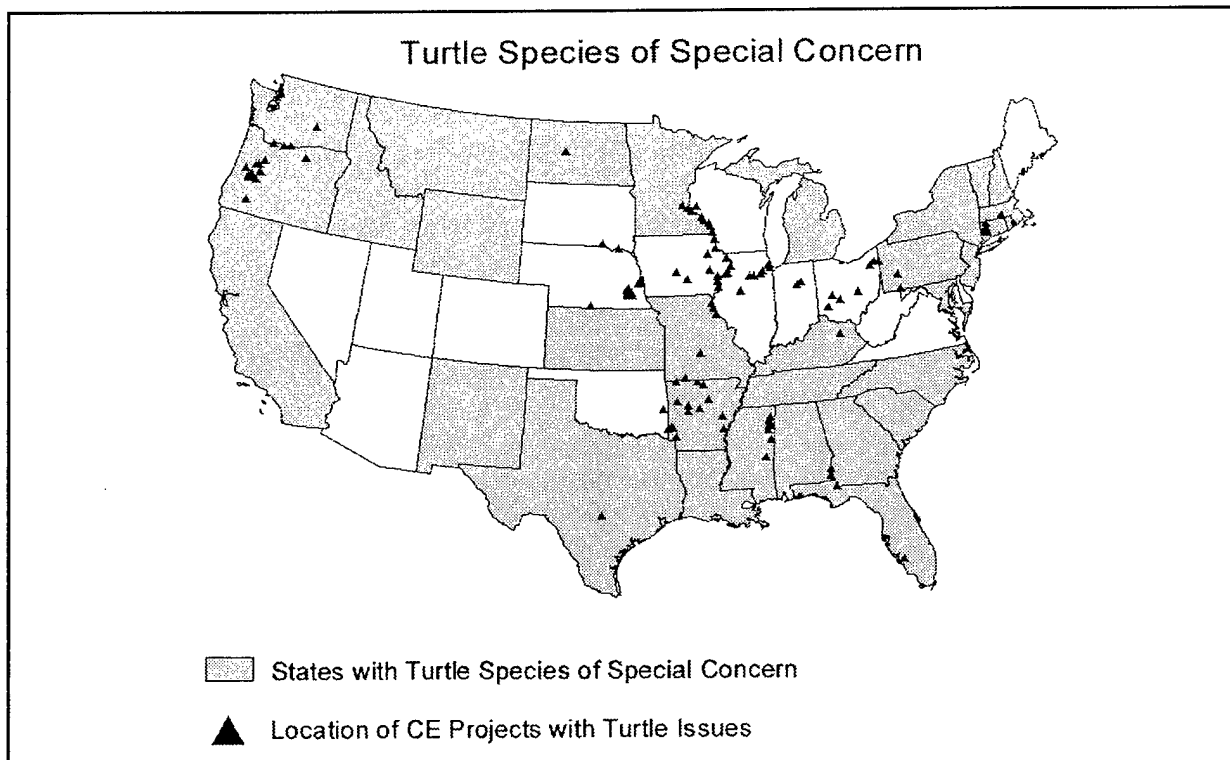


Figure 2. Priority turtle species

Table 1
Turtles Potentially Impacted by Reservoir Operations

Turtle Group	Turtle Common Name	Scientific Name	Protection Status
Snapping Turtles	Alligator snapping	<i>Macrolemys temminckii</i>	FC
	Common snapping	<i>Chelydra serpentina</i>	O
Map/Sawback Turtles	Cagle's map	<i>Graptemys caglei</i>	FC
	False map	<i>G. pseudogeographica</i>	S
	Ouachita map	<i>G. p. ouachitensis</i>	O
	Map	<i>Graptemys geographica</i>	S
	Black-knobbed sawback	<i>Graptemys nigrinoda</i>	S
	Ringed sawback	<i>Graptemys oculifera</i>	FT
Wetland Turtles	Blandings	<i>Emydoidea blandingii</i>	FC
	Bog	<i>Clemmys muhlenbergii</i>	FT
	Wood	<i>Clemmys insculpta</i>	S
	Spotted	<i>Clemmys guttata</i>	S
	Western pond	<i>Clemmys marmorata</i>	S
Riverine Turtles	Western chicken	<i>Deirochelys reticularia</i> (ssp)	S
	Painted (western and southern)	<i>Chrysemys picta</i> (ssp)	C
	Red eared	<i>Trachemys scripta elegans</i>	C
Softshell Turtles	Smooth softshell	<i>Apalone mutica</i>	C
	Eastern spiny softshell	<i>A. spinifera spinifera</i>	C
	Spiny softshell	<i>A. spinifera</i>	S
Mud/Musk Turtles	Yellow mud	<i>Kinosternon f. flavescens</i>	S
	Illinois mud	<i>K. f. spooneri</i>	FC
	Stinkpot	<i>Sternotherus odoratus</i>	S
Terrestrial Turtles	Ornate box	<i>Terrepene o. ornata</i>	S
	Eastern box	<i>Terrepene c. carolina</i>	S
	Gopher tortoise	<i>Gopherus polyphemus</i>	FT

FT Federally threatened
 FC Federal candidate for protection
 S State protected
 C Species of special state concern
 O Other protection status

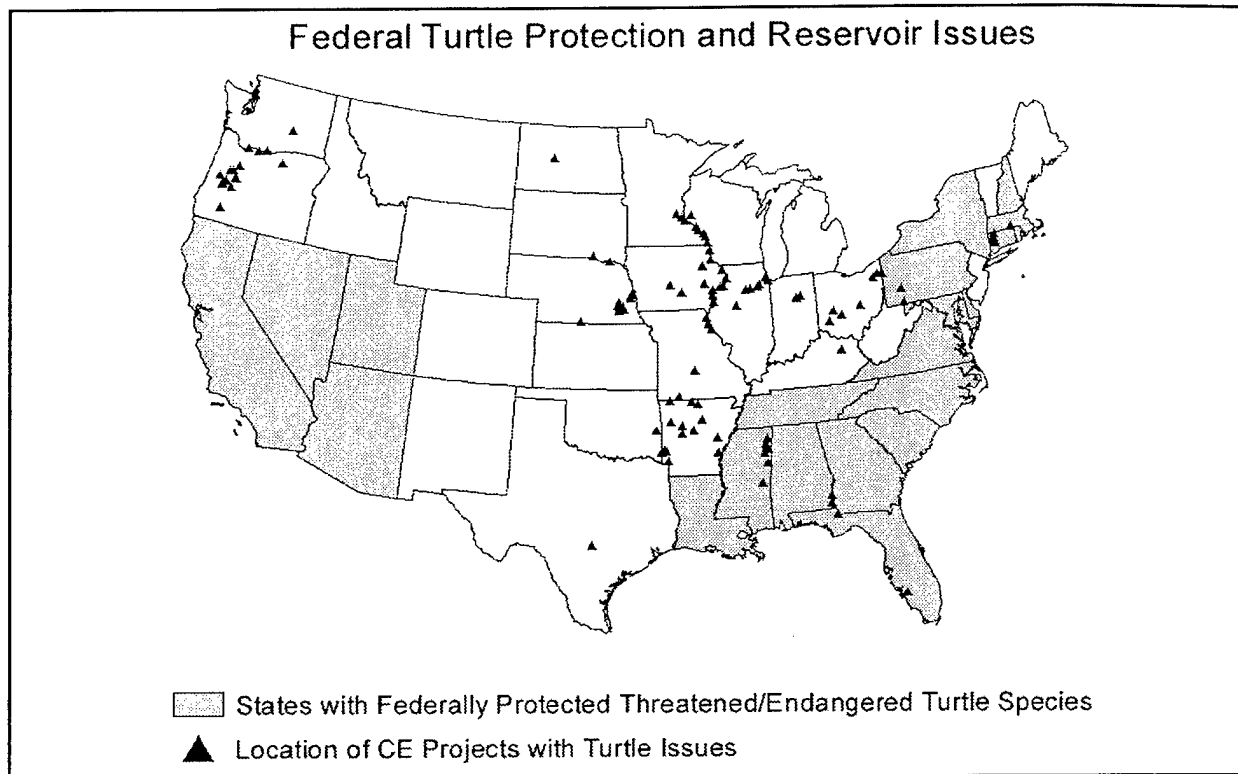


Figure 3. Federal listings for turtle species protection

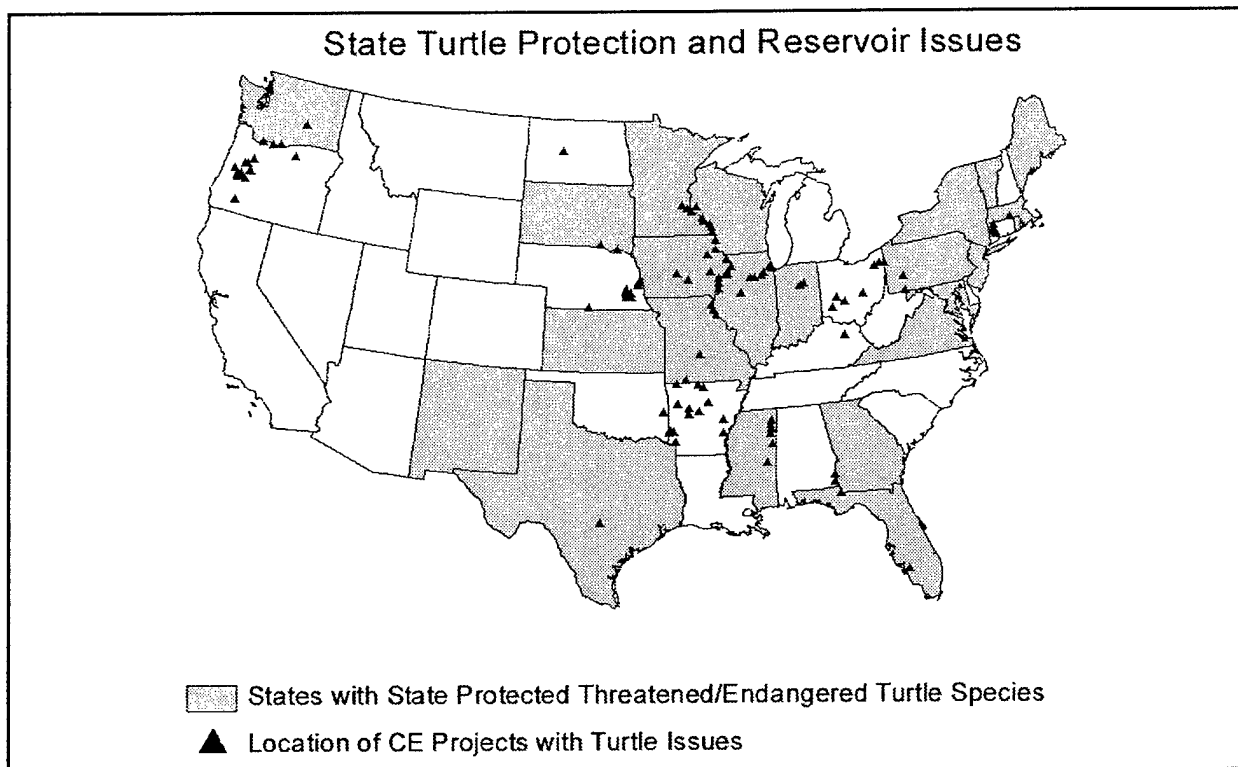


Figure 4. State listings for turtle species protection

SUMMARY OF POTENTIAL IMPACTS IDENTIFIED

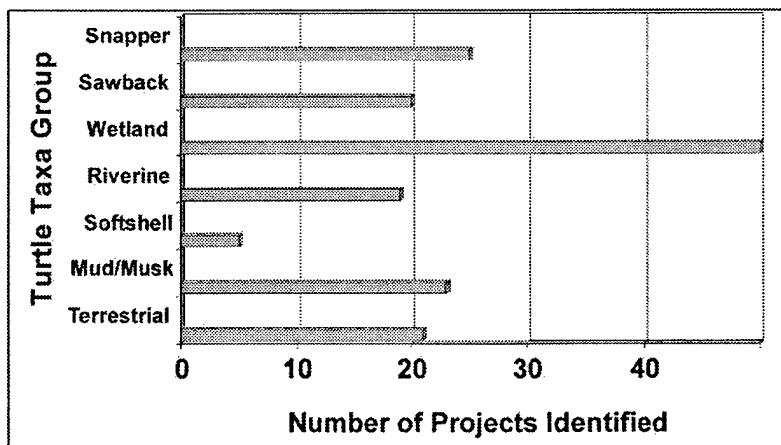
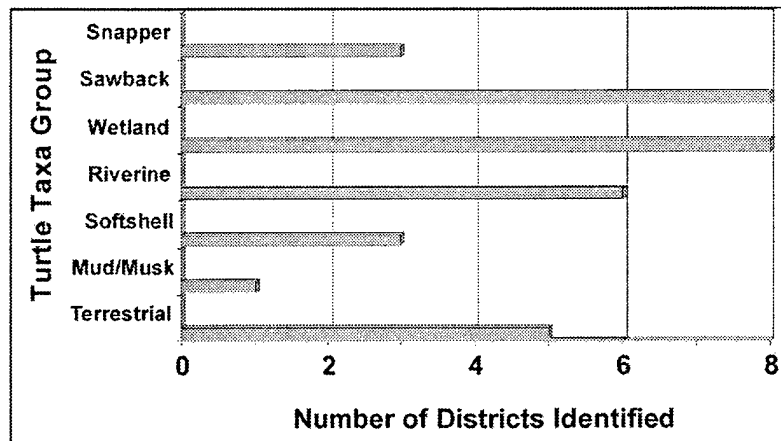
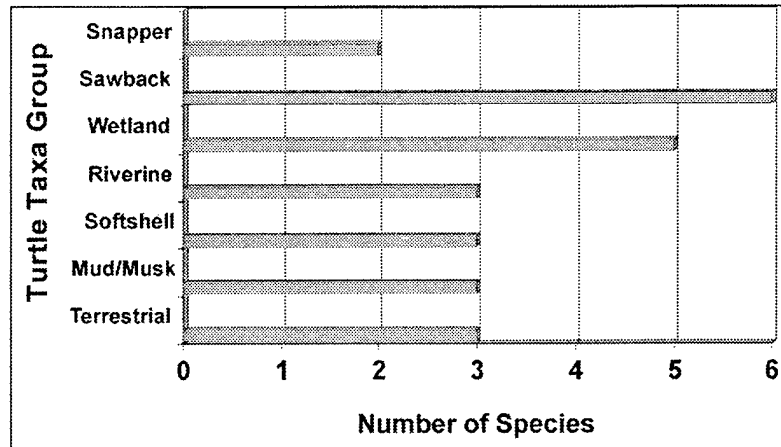


Figure 5. Potential impacts identified

SURVEY RESULTS: The 456 USACE reservoir and water-control structure projects surveyed represented 31 USACE Districts. Of these, personnel from 319 projects (70 percent) responded, which represented 30 Districts. From the projects that responded, 105 responses (33 percent) indicated known issues concerning environmentally sensitive turtle species and 214 (67 percent) indicated no known turtle-related issues. The 105 projects with potential turtle issues represented 14 Districts and 6 Divisions (Table 2). A total of 25 species of turtles were identified at the 105 projects. These 25 species include 3 Federally protected species, 4 species currently being considered for Federal protection, and 18 species with protection in at least one state (Table 3). The 25 turtle species were categorized into 7 groups according to their habitat or life-history requirements. The 7 groups included snapping, map or sawback, wetland, riverine, softshell, mud or musk, and terrestrial turtles.

TURTLE GROUPS AND HABITAT DESCRIPTIONS

Snapping Turtles. This group includes only two species; the alligator snapping turtle and common snapping turtle. The alligator snapping turtle is restricted to U.S. river systems that drain into the Gulf of Mexico, whereas the common snapping turtle range extends throughout the United States east of the Rocky Mountains (Ernst et al. 1994). Both species prefer benthic living and foraging and are opportunistic omnivorous scavengers. Alligator snapping turtles most frequently occur in the deep water of rivers, canals, and lakes. Common snapping turtles can be found in almost every kind of freshwater habitat. Although biological data on alligator snapping turtles are severely lacking, reports of population declines have been attributed to commercial harvesting for food and to the pet trade (Pritchard 1989). Common snapping turtles are among the more abundant aquatic turtles; however, overcollecting has seriously reduced many populations (Ernst et al. 1994). Alligator snapping turtles are Federal candidates for protection and in 15 states, common snapping turtles are either listed as state species of special concern or carry harvesting regulations. Environmental issues associated with these turtles were reported by 25 USACE projects from 3 Districts.

Map and Sawback Turtles. This is a large group, of which 11 species have either Federal or state protection. Six of these species have been associated with environmental issues at 20 USACE projects from 8 Districts. Distribution of these turtles is species-specific. They collectively range throughout the river systems from Ohio, Indiana, Illinois, Wisconsin, Minnesota, and the Dakotas southward to southwestern Alabama and westward to eastern Texas (Ernst et al. 1994). These turtles prefer waters with moderate to fast currents, abundant basking structures, and wide sandbars (Haynes and McKown 1974; Harvey 1992; Dickerson and Reine 1996). Mollusks and other invertebrates are the primary food items for all species of this group. Basking is an important component of the daily activity of map and sawback turtles; therefore, the quantity and quality of basking structures will significantly influence their occurrence within a habitat (Dickerson and Reine 1996). Population declines for many of these species are directly attributed to habitat destruction and overharvesting for the pet trade (Ernst et al. 1994).

Wetland Turtles. This group includes one Federally threatened, one Federal candidate, and three state-protected turtle species. These five species were reported to have presented conservation issues at 50 USACE projects from eight Districts. The collective range for these turtles includes states of the northeastern United States region and Atlantic and Pacific coastlines (Cook

Table 2 Corps Districts and Divisions Potentially Impacted by Turtle Issues										
Division	District	Turtle Taxonomic Groupings							Total Number Turtle Groups	
		Snapping	Sawback	Wetland	Riverine	Shoofshell	Mud/Musk	Terrestrial		
LRD	Huntington		X	X	X			X	4	
	Louisville		X	X				X	3	
	Pittsburgh	X		X		X			3	
MVD	Rock Island	X	X	X	X	X	X	X	7	
	St. Paul		X	X	X				3	
	Vicksburg		X						1	
NAD	New England			X					1	
SAD	Jacksonville							X	1	
	Mobile		X					X	2	
NWD	Omaha		X	X					3	
	Portland			X	X	X			2	
SWD	Fort Worth		X		X				1	
	Little Rock	X			X				2	
	Tulsa				X				1	
Total Districts	14	3	8	8	6	3	1	5		
Total Divisions	6	3	5	4	4	3	1	3		

Table 3
Summary of Turtle Protection Status

States		Turtle Groupings								
		Snapping		Map/ Sawback	Wetland	Riverine	Softshell	Mud/ Musk	Terrestrial	
		Alligator	Common						Box	Tortoise
North Central	KY					C	C		R	
	MO	C	R		S	S	R-2	S-2		
	IA				S			S-2	S	
	MN		C		S-2		C			
	WI		R		S-2		R-2		S	
	IN	S			S-2	S		S	S	
	IL	S			S	S		S		
	OH									
	MI		R		C-3		R-2		C	
	WV		R	R-2	R-2	R-6	R-2	R	R	
Midwest	ID					C				
	MT		C				C			
	WY									
	CO									
	KS	C		S						
	NE		R							
	ND		R	C			C			
	SD			S	S					
Southwest	NM					S,C				
	AZ						R			F
	NV									F
	UT									F
Pacific	CA				C		R	C		F
	OR				C	C				
	WA				S	C				
	HI									
	AK									
Total		13	17	15	27	20	16	15	17	11

F = Federally listed species (threatened and/or endangered)

S = State listed species (threatened and/or endangered)

C = State species of special concern

R = State regulated for possession and/or harvesting

-Number= Number of species protected per category

1984; Graham et al. 1987; Ernst et al. 1994). Typical habitats include shallower bodies of water such as wetland habitats including swamps, bogs, wet pastures, ponds, and riparian areas of streams and rivers. They are not associated with the larger rivers of the Mississippi Valley watershed. Some of these species are considered semiaquatic. All of these species are omnivorous scavengers with the bulk of their diet consisting of invertebrates (Holub and Bloomer 1977; Bury 1986). Destruction of wetland habitat and collection for the pet trade have caused extinction of some populations and severely reduced others (Collins 1990).

Riverine Turtles. This group includes the largest number of species, of which 13 have state protection, 2 are listed as Federally endangered, and 1 is a Federal candidate for legal protection. Although the riverine turtle group contains the most species, only 3 species were reported as having potential environmental issues at some USACE projects (19 projects from 5 Districts). Distribution of these turtles is species-specific; however, the collective range of this group covers all but the Pacific coastal, southwestern, and midwestern regions of the United States (Ernst et al. 1994). These turtles occupy most freshwater habitats within their range but prefer quiet waters with soft bottoms, an abundance of aquatic plants, and suitable basking sites (Ernst and Barbour 1972). Adults of these turtles primarily feed opportunistically as omnivorous scavengers. Young turtles in this group are primarily carnivorous. While volumes of literature are available for some species within this group, very sparse information exists on others. Environmental contamination (i.e., pesticide poisoning) and excessive collecting for the pet trade have severely impacted populations in some areas (Hall 1980, Warwick et al. 1990).

Softshell Turtles. This group of peculiar-looking turtles includes four species with legal protection in at least one state and none with Federal protection status. Three of these species are associated with environmental issues at six USACE projects from three Districts. These turtles are widely distributed throughout the United States; however, the four species with state protection status primarily occur within the Mississippi and Ohio River watershed (Ernst and Barbour 1972). Typical habitat is large rivers and streams with moderate to fast currents, soft or sandy bottoms, aquatic vegetation, and nearby sandbars. The softshell turtles were placed in a group separate from riverine turtles because of certain behaviors unique to these turtles (i.e., burying in the soft bottom with only the head and neck protruding) and their peculiar physical characteristics. Softshell turtles are predominantly carnivorous; however, they sometimes consume plant matter. Habitat destruction and overharvesting for food have contributed to significant reductions in populations in some areas (Ernst et al. 1994).

Mud and Musk Turtles. This group includes ten species with legal protection in at least one state and one Federally threatened species. Three of these species are associated with environmental issues at 23 USACE projects from one District. The collective range for these 10 environmentally sensitive species is widespread throughout the central, southeastern, and Atlantic coastal regions of the United States. Mud and musk turtles are found in almost any quiet water within their range to include: swamps, wetlands, sinkholes, rivers, creeks, ponds, lakes, reservoirs, etc. (Ernst et al. 1994). Mud and musk turtles are placed in a separate group because of morphological and behavioral differences as well as the diversity of aquatic systems inhabited. Diet varies somewhat geographically but consists primarily of aquatic invertebrates. Habitat destruction is mainly attributed to declines in mud and musk turtle populations.

Terrestrial Turtles. This group includes the tortoises and box turtles, with two species Federally threatened and three species having protection in at least one state. Three of these protected species are associated with environmental issues at 21 USACE projects from five Districts. The three species of tortoises occur in three isolated regions of the United States (southwest, southern Texas, and coastal southeast). The two protected species of box turtles occur throughout a wide range of the eastern United States, but remain protected in only certain states for various reasons. Although both tortoises and box turtles are terrestrial, their preferred habitats vary significantly between groups as well as species. Habitats include strictly desert, longleaf pine, prairie, and open woodlands. These turtles are known to have well-defined home ranges within a habitat. Gopher tortoises are strictly herbivorous and feed primarily on grasses, whereas box turtles are omnivorous. Habitat destruction, pesticide poisoning, collection for food and the pet trade, and disease have all been attributed to dramatic declines in populations.

ISSUES OF CONCERN: Operations such as changing water levels at reservoirs or other water-control structures may impact critical habitat parameters for some turtles. These impacts could further reduce population numbers of turtles that are already listed as state or Federal endangered, threatened, or special concern species. Environmental issues reported by personnel from USACE projects, the U.S. Fish and Wildlife Service, and state conservation agencies vary regionally and by turtle taxonomic group. Few studies have addressed these environmental issues.

Habitat changes that alter critical food supplies may impact specific or all size classes within a species or taxonomic group. Map turtles may be extremely prone to impacts from fluctuations in food supply because of the narrow range in food items in their diet. Reductions in the number of suitable basking structures can severely change the distribution of species with strong basking tendencies. These concerns were primarily reported for the map/sawback and riverine turtle groups. Fluctuations in water levels during months of cold weather may flood hibernation sites and potentially drown vulnerable turtles. This was reported as an environmental issue of concern for the snapping, wetland, mud/musk, and terrestrial turtle groups. For all turtle groups, the most commonly reported issues regarded potential destruction or alteration of nesting habitat. Potential environmental impacts from these issues may include changes in species distribution, declines in population number, or shifts in population structure.

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